differences existing between them in certain properties, the discovery and investigation of which is of the last importance for the theory of liquid diffusion.

Hydrochlorates of Morphine and Strychnine.—Time of diffusion 11·43 days. The quantity diffused was determined from the chlorine, which was precipitated as chloride of silver in an acid solution.

These two analogous salts appear to approach very closely in diffusibility.

Diffusion from 2 per cent. solutions at 64°·1 ; two cells :—

Hydrochlorate of morphine.....	11·60	100
Hydrochlorate of strychnine	11·49	99·05

The diffusion of these salts of organic bases in 11·43 days, is exceeded by the diffusion of chloride of ammonium or potassium in 5·71 days, or half the former time. The vegeto-alkalies appear thus to be divided from ammonia and potash.

12. "On the Mutual Relations of the Vital and Physical Forces." By William B. Carpenter, M.D., F.R.S. &c.

The purpose of the author in this communication is to show that the same kinds of "Correlation" as has been pointed out by Prof. Grove to exist among the physical forces,—light, heat, electricity, magnetism, chemical affinity, and mechanical motion,—exists also between these forces and those which operate in the development of living beings, and in the production of all their vital actions.

1. In some introductory remarks, the author briefly recapitulates the leading ideas which have been entertained by physiologists with respect to the relations between the physical and vital forces ; and states it to be the doctrine at present in vogue, that vital forces are the manifestations of the dormant properties of organized structures, called into activity by the physical forces which operate as *stimuli*.

2. He then examines into the mutual relations of the several vital forces; and adduces facts and arguments to prove that the forces of assimilation, organization, chemico-vital transformation, and histological transformation, which are concerned in the development and maintenance of living organisms, are so many *modes* of one and the same vital force, whose most general operation is seen in *cell-formation*. And he then goes on to show that the production of the nervous and muscular forces, and of ciliary movement, are due to the same agency. Lastly, he points out that the nervous force, originating in one act of cell-formation, can in its turn influence other acts of the same kind, and can thus modify every other kind of vital operation. Whence he concludes that all these vital forces are "correlated."

3. The author then investigates the relations of the vital and physical forces to each other. Taking the nervous force as the most characteristic example of the former, he shows that it is correlated to electricity, heat, light, chemical affinity, and mechanical motion. He then endeavours to prove that the same correlation exists between *heat* and the organizing forces; so that the latter may be con-

sidered as in reality due to a transformation or conversion of heat by its passage through an organized structure; just as heat, acting through a certain mixture of metals, manifests itself as electricity. Hence he concludes that the physical forces are as closely correlated to the vital, as those of each category are to each other; the chief distinction between their respective operations being established by the speciality of the instruments through which they manifest themselves.

13. Letter from Lieut. Gillies, U.S.N., to Lieut.-Col. Sabine, R.A., For. Sec. R.S.

U.S.N. Astronomical Expedition,
Santiago de Chile, 20th Jan. 1850.

Dear Sir,—I had the pleasure to receive your letter of Aug. 3rd by the last monthly steamer from the north, and greatly lamented I could not answer it by the mail, which left Dec. 30th. Leaving the United States on the 16th of August, want of a proper amount of fire surface in the boilers of the steam-ship, caused my arrival at Chagres only on the day (27th) when the mail for Chile left. A month was thus unavoidably lost; for in anticipation of a passage through without delay, all instruments, except an aneroid barometer and thermometer, had been despatched round Cape Horn. With these such observations were made, until arrival here, as their construction permitted. From the indications of the aneroid there is a region extending from 200 miles to the S.S.W. of San Domingo to about 1° of north latitude on this side of the continent, where the pressure rarely exceeds 29·850 in., nor was the barometer but once in that whole distance as high as 29·900 in. At Panama the mean is 29·795 in. from observations at 9 A.M., 3 P.M., and 9 P.M., with a mean diurnal fall from the first to the second hours of ·08 in. The temperature for the same hours was 81°·0 with a range of 2°·9, and almost constantly saturated with moisture, though rain fell no more frequently than often occurs during the same period in the United States. As evidence of the hygrometric condition of the atmosphere, it was found impossible to dry clothing in my room after several days' open exposure, and they were finally exposed to the direct rays of the sun. Leather moulds in forty-eight hours. The light wind experienced was almost constantly from the northward and westward during the day, and variable at night. I think Lieut.-Col. Emery made observations for declination and dip *en route* for California, but nothing is known to me of the results, and I must await our return to give you data on these points. Should nothing intervene to change present intentions, I contemplate making observations at each of the fifteen ports where the steamer touches between Valparaiso and Panama. Nothing of note occurred during our passage to Chile. There was time to glance at Buonaventura, Guyaquil, Payta, Huanchaco (part of Truxillo), Casma, five days at Lima, Pisco, Islay, Arica, Iquique, Coleiga, Copiapò and Coquimbo,—a multitude of little towns unimportant in themselves, and mentioned